RED BLOOD FROM GREEN LEAVES

In recent publications we have received from abroad there was mention of the surprising healing properties that chlorophyll, the green coloring matter of plants, has been discovered to possess. As the subject seems particularly topical at a time when thousands of people are being wounded and injured every day, we have asked Dr. H. Wilpert, a German biologist living in Shanghai, to combine these reports with a short résumé of what science knows about this subject.—K.M.

THERE have been various reasons for science's efforts to uncover the secrets of chlorophyll. The significance of this substance becomes clear when one bears in mind that it is only with the aid of this green plant pigment that nature can employ the rays of the sun to produce carbohydrates from carbon dioxide and water. These carbohydrates, in turn, are used by the plants in the synthesis of fats and albumens. The building up of these primitive substances is only possible with the aid of chlorophyll. Animals and the human being are unable to build them up on their own and must use the substances contained in the plants to nourish themselves. So the plant, or rather the chlorophyll, is a fundamental condition for all animal and human life.

Apart from their natural curiosity as to how the plant manages to build up these substances, scientists believed that it would be possible one day to copy this process on a large scale, as there is no lack of the basic substances—carbon dioxide and water.

In 1913, Dr. Richard Willstaetter of Munich discovered some facts which give an indication of how chlorophyll may possibly have a catalytic influence on chemical reactions in the plant. But today there are far more problems than solutions in this respect, and we have not come a single step closer to a technical application of the process. The whole secret is embedded in the tiny plant cell, which does such manifold work that it is quite impossible to survey all its simultaneous functions.

Willstaetter revealed the molecular structure of chlorophyll, and it became apparent that, surprisingly enough, the chlorophyll molecule is very similar to the red blood pigment, the hemoglobin. Both possess nearly the same structure with the characteristic difference that the central atom in the latter is an iron atom, while the central atom in the chlorophyll molecule is magnesium. Later Bürgi made detailed physiological studies of chlorophyll and found that its physiological effect with regard to its reaction to oxygen was also identical to that of the red blood pigment.

In view of the fact that chlorophyll is so similar in its molecular structure to that of the red blood pigment, it was an obvious step to use chlorophyll as a strengthening drug and for the treatment of anemia. It might be objected that, after all, sufficient quantities of chlorophyll are taken every day with the consumption of vegetables. The reply to this is that the chlorophyll in plant cells is enclosed by comparatively strong cell walls, so that the human body is not always able to make use of it. Moreover, there are only tiny quantities of chlorophyll contained in a plant: only 1 per cent of the dry substance consists of chlorophyll, and in the case of edible plants the dry substance hardly ever accounts for more than 20 per cent of the total. In other words, 100 grams of vegetables contain no more than about 0.2 grams of chlorophyll. Hence the chlorophyll preparations prescribed for these purposes are actually chlorophyll extracts. Some of these preparations contain a small additional quantity of iron, since the red blood pigment contains iron.

The latest and most promising medical application of chlorophyll is in the field of infections. Well-known medical experts have reported numerous cases in which chlorophyll has conquered deep-set infections, healed open wounds, given relief in cases of chronic inflammation of the lymph gland, and prevented ordinary colds.

At Philadelphia's Temple University it was discovered that chlorophyll strengthens the walls of animal cells. This observation led to the question: Would it not be pos-

sible to employ chlorophyll to fight bacteria? Even the best antiseptics usually have one disadvantage in that, if they are strong enough to kill the causes of the disease, they often disturb the function of the surrounding tissue at the same time. Might chlorophyll enable the body to fight the invading bacteria and yet spare the tissue?

Laboratory experiments have shown that, in itself, chlorophyll does not have the power to kill off bacteria. But when it is in contact with live tissue it seems to strengthen the cells' power of resistance and to hamper the growth of bacteria. Its specific ability of breaking down carbon dioxide and releasing the oxygen spells doom for the bacteria, which can only live in suppurating wounds beyond the reach of air. Even in generous doses chlorophyll has shown no irritating effect. The department for experimental pathology at Temple is now preparing various ointments containing chlorophyll for all kinds of infections and is experimenting with them. Incidentally, ointments containing chlorophyll, usually in addition to sulfonamides, have already been marketed in China.

Last year, a dozen well-known doctors published their experiences with chlorophyll in the *American Journal of Surgery*. All in all, some 1,200 cases, from deep-seated infections to superficial skin injuries, had been treated by these men, and in case after case the report ended: case cured. Patients arrived with a ruptured appendix and incipient peritonitis; after the necessary operation, a chlorophyll solution was successfully applied to the deep wound by means of a tube. In other cases a compress with chlorophyll or an ointment containing chlorophyll was applied. Serious bone diseases, inflammation of the brain, and many cases of mouth infections, *angina vincenti*, and *pyorrhea alveolaris* have been cured.

For quite a number of years, chlorophyll preparations for injection have been marketed by reputable firms for the treatment of tuberculosis and arteriosclerosis. The American specialists Robert Ridpaths and T. Carroll Davis have had excellent results in the treatment of 1,000 cases of infections of the respiratory organs. They reported that they had not seen a single case treated with chlorophyll where the patient had not been either completely cured or at least shown considerable improvement. Chlorophyll tampons inserted in the nose during colds have been outstandingly successful in giving instant relief. Patients with a cold in the head or the nose were greatly relieved within twenty-four hours.

How does chlorophyll destroy bacteria or hamper their growth? Beyond the facts that it strengthens the cell walls, hampers the growth of the bacteria, and gives the body a chance to mobilize its own defenses, doctors know very little. Perhaps there is something in the theory that the effect produced by chlorophyll is produced by its hampering influence on the vitamin metabolism of the bacteria, which latter are—like humans and animals—dependent on the presence of certain substances of a vitamin character.

PENICILLIN—MEDICINE FROM MOLD

By HANNS WIRTZ

During the last few months, various sensational reports have appeared in the press about a new drug called penicillin which is supposed to possess miraculous healing properties. "Time," in its issue of March 15, 1944, went so far as to say: "Penicillin will save more lives than war can spend," and even Churchill mentioned the new drug in one of his speeches.

We have just received detailed material on penicillin from Europe, and Dr. Hanns Wirtz of Shanghai, who obtained his degree in pharmaceutics at the University of Bonn, Germany, tells our readers about the nature and significance of the new medicament in the following article.—K.M.

WHEN Robert Koch proved more than sixty years ago that a certain group of diseases, now known under the collective name of "infectious diseases," has its cause in the activity of numerous kinds of tiny parasites such as bacteria, protozoa, or fungi, he laid the foundation for effective countermeasures. Once an enemy is recognized, it is possible to lay bare his weak points and to construct the necessary defensive weapons. The same applies to the infectious diseases. Starting out from Koch's